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# HORSE BEANS



**H**ORSE BEANS have been grown in the Old World since very ancient times and are valuable as forage, as green manure, and as a vegetable.

Heavy loams or clay-loam soils are best suited for horse beans, but the crop is not very exacting as to soil requirements.

All horse-bean varieties are winter-growing annuals and require cool weather for their best development. The hardier varieties will stand with little injury a temperature of 15° F. above zero. Some of the tenderer varieties, however, will stand but little freezing. Where severe winters prevail, horse beans must be sown in early spring. In regions having mild winter conditions they should be sown in the fall. Plantings should be in rows 24 to 30 inches apart.

Planters used for Lima beans and the smaller seeded varieties of field beans can be used for horse beans. Horse beans planted on land for the first time require inoculation.

Only sufficient cultivation to keep down weeds need be given.

Horse beans should be cut for seed as soon as the lower pods are mature and the upper ones fully developed. They must be handled as rapidly as possible, as the seed shatters easily.

Under favorable conditions the seed yields are heavy. An average yield is about 1½ tons per acre.

The seed of horse beans retains its vitality for a long period. In germination tests, seed 4 years old has shown only slight, if any, deterioration.

# HORSE BEANS.<sup>1</sup>

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## CONTENTS.

	Page.		Page.
Description of the horse bean.....	3	Inoculation.....	8
Uses.....	4	Cultivation.....	8
Soil requirements.....	6	Harvesting for seed.....	8
Climatic requirements.....	6	Longevity of seed.....	11
Time of seeding.....	6	Fungous diseases.....	11
Method of seeding.....	7	Insect enemies.....	11



HORSE-BEAN varieties are numerous and it seems probable that their number, even in the earliest days of agricultural history, was large. The date of the introduction of the horse bean into America is unknown, but the crop has been grown to a limited extent for a number of years in most of the countries of North, Central, and South America. It succeeds best in the regions near the sea, and the Maritime Provinces of Canada and the Pacific Coast States contain practically the entire acreage in North America, and similarly situated sections in China, Japan, Java, and Madagascar have proved favorable locations for the crop.

The high yield and quality of this crop, as demonstrated in the experimental and commercial fields on the Pacific coast, together with its high feeding value, indicate that it can be used to advantage much more extensively in this country than is the case at the present time.

## DESCRIPTION OF THE HORSE BEAN.

The plants of horse beans live only one season. They are erect, with one or more large unbranched stems which attain a height of 2 to 6 feet. The leaves are abruptly pinnate and usually with six leaflets, which are large, oval, and without special markings. Large white flowers with dark-purple markings are borne on short pedicels in clusters of one to five in the axils of the leaves. (Fig. 1.) From one to four pods develop from each flower cluster. The varieties bearing large pods usually have one pod in a place, but the smaller podded varieties generally have two or three. The size and color of the seed vary with the varieties. They may be black, purple-black, green, or various shades of brown, the latter being the color of the more common varieties. The size varies from about 1 inch in length in the large flat-seeded varieties to one-fourth inch in the varieties having small, plump, or nearly round seeds. (Fig. 2.)

*Common names.*—In European countries the large flat-seeded varieties of horse beans are known as broad beans and the small-seeded varieties as tick beans. There are a large number of varieties, the more common being the Windsor, Longpod, Dwarf Fan,

Julienne, Lorraine, Black Spanish, Mazagan, Pieardy, and Winter. In the United States the large flat-seeded varieties are most commonly grown and are known to the commercial trade and elsewhere as horse beans only. Recently a large flat green-seeded variety of horse bean has been advertised in this country as the Lindsay-Johnson Winter bean.

#### USES.

The large flat-seeded varieties of the horse bean are used quite extensively as a vegetable either in a green or dry state, while the



FIG. 1.—Horse beans in flower. The flowers are white with purple markings. One to four pods develop from each flower cluster.

smaller seeded varieties are seldom used as a vegetable. As a green vegetable the large varieties are grown as a home-garden product or for canning purposes. When used in these ways, the beans are allowed to become full grown, but are picked before they become hard. When used as a vegetable in the dry state, they are prepared in the same way as any of the common beans.

The large-seeded varieties have been grown, especially in European countries, as a stock feed, though the small-seeded varieties are most commonly used for this purpose. The feeding value of horse beans is high and is considered in some cases to be superior to field peas or other leguminous crops. This high feeding value together with the

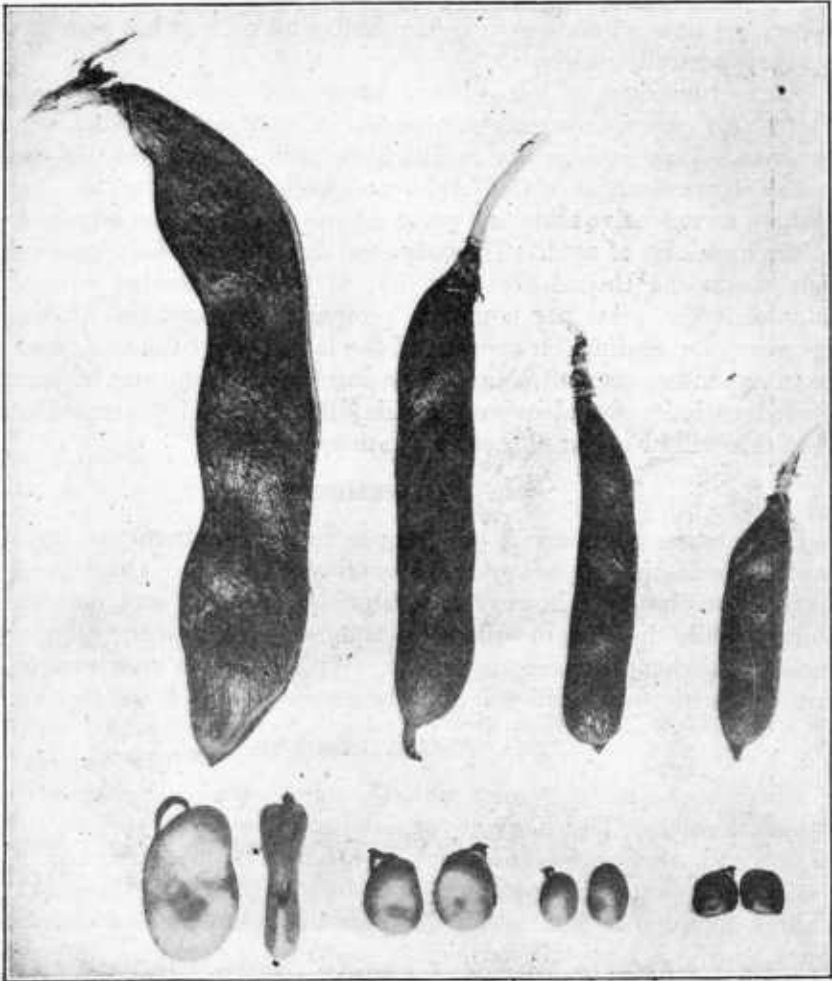


FIG. 2.—Seeds and pods of large, intermediate, and small seeded varieties of horse beans. The large flat-seeded varieties are used as a vegetable. (Two-thirds natural size.)

fact that the yield of seed is very large makes it a crop that often can be grown for stock feed when other leguminous crops would be prohibited on account of the cost of production.

In the United States practically the only use that has been made of horse beans is for vegetable purposes; and while they have been grown more or less for use in a green state, large commercial plant-

ings have been made for the production of matured beans for use as a dry vegetable. However, some use has been made of them for stock-feeding purposes, and in some of the bean-growing sections of California they have been harvested by "hogging down," with very satisfactory results. The horse bean is of little value as hay, and stock do not seem to care for the stems and leaves in the green state; but in combination with corn and sunflowers it has been used quite successfully as silage.

Various varieties of horse beans have been tested in the United States for green-manuring purposes in comparison with other legumes. Very satisfactory results have been obtained in this work in the citrus districts of California, and while the crop has not been used on an extensive scale as a green manure this has been largely due to the high cost of seed. The only seed available in the commercial markets in the United States is that of the large-seeded varieties, and while the price per pound is comparatively low the quantity necessary for seeding, on account of the large size of the seed, makes it an expensive crop to plant. The introduction and use of small-seeded varieties would overcome this difficulty, and it seems likely that this will be accomplished in the near future.

#### SOIL REQUIREMENTS.

Horse beans are not very exacting as to soil requirements, but do best on well-drained heavy loam or clay-loam soil. Good results have been obtained, however, both on quite heavy and on sandy soils. While the type of soil makes some difference to the crop, soil moisture perhaps is more important. With sufficient moisture present, any fairly fertile soil will produce a good crop of horse beans.

#### CLIMATIC REQUIREMENTS.

Horse beans require practically the same climatic conditions as common vetch. The hardier varieties stand a winter temperature of 15° F. above zero without serious injury. Some of the tenderer varieties, however, will stand but little frost. (Fig. 3.) Horse beans are not adapted to intense heat or even moderately warm temperatures, and it is essential for their successful development that they have a growing season that has but little or no excessive heat. Aside from being unfavorable to the normal development of the plant, high temperatures favor the development of certain fungous diseases, which often do serious damage.

#### TIME OF SEEDING.

In localities having mild winter conditions, such as prevail in the Southern and Pacific Coast States, horse beans of most varieties can be sown in the fall and will go through the winter in perfect condition.

In these States seeding can be done in September, October, or November, the exact time depending quite largely upon the soil moisture available in those months.

In northern localities, or at high elevations farther south where severe winter conditions prevail, planting should be done as early in

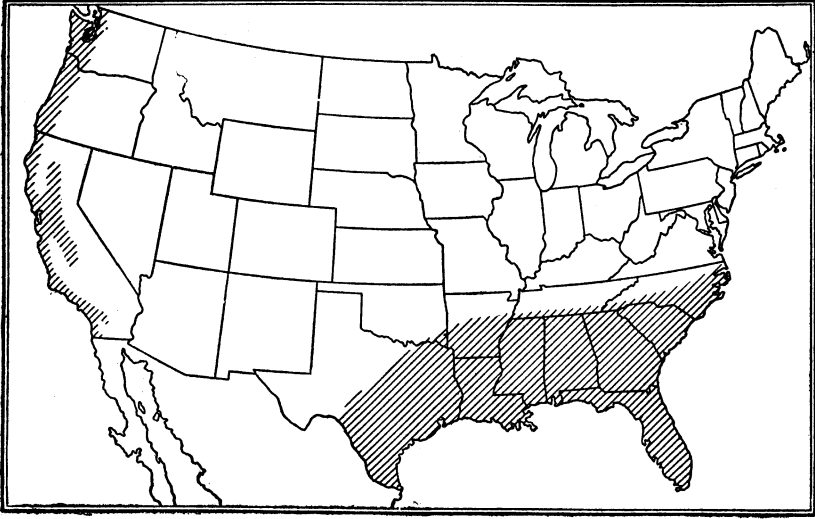


FIG. 3.—Outline map of the United States, the shaded portions showing the areas where the climatic conditions are favorable to the fall seeding of horse beans.

the spring as the ground can be worked. The seeding time for the earliest ordinary spring crops is the best time for seeding horse beans under such conditions.

#### METHOD OF SEEDING.

Horse beans can be satisfactorily planted with planters used for field beans. The large-seeded varieties can be sown with planters used for Lima beans, while the smaller seeded varieties can be sown with those used for the smaller seeded kidney beans. Some of the smaller seeded varieties can be planted with a common corn planter, but the larger seeded varieties can not be handled with such implements. In California, where most of the horse beans in the United States are grown, much of the planting is done by hand. The field is plowed shallow at seeding time and the seed dropped in every second or third furrow. The usual method is to make the rows about 30 inches apart and to drop the seeds 6 inches apart in the rows. Rows 24 inches apart, or even closer, will give good results under favorable conditions, but usually wider planting is preferable.



### INOCULATION.

As is the case with most, if not all, legumes, the inoculation of horse beans is essential for the best results. In the better loam soils of California artificial inoculation does not seem to be essential, as the necessary bacteria apparently are present in the soil. On less favorable soils and in places where horse beans have not been grown successfully, inoculation is desirable, and in some cases perhaps essential. In western Oregon and western Washington inoculation has been found desirable, and it is advised in all parts of the United States where horse beans are grown for the first time.

The easiest method of inoculation, and one perhaps as effective as any other, is to mix a small quantity of inoculated soil with the seed at the time of seeding. The quantity of soil used need be only enough to give a mere dusting to the seed, which will in no way interfere with seeding operations. Inoculation can be obtained also by scattering inoculated soil at the rate of 500 pounds per acre over the field immediately preceding planting. When soil is used in this manner a harrowing should be given the field immediately following the application of the inoculated soil, so as to incorporate it with the soil of the field and furnish favorable conditions for the protection and growth of the bacteria. When soil for inoculation is not available, pure cultures can be used.

### CULTIVATION.

Horse beans should be given thorough cultivation throughout their growing period. When planted in 24-inch rows or closer, special machinery is necessary for cultivation. When plantings are made in 30-inch rows, however, a number of the ordinary cultivators can be adjusted so they can be used. Thorough cultivation is necessary in order to keep the soil in good physical condition and to keep down weed growth and thus make conditions more favorable both for growing and harvesting the crop. The number of cultivations that should be given will depend upon local conditions, but usually cultivation sufficient to prevent the growth of weeds is all that is necessary and ordinarily this involves as much labor as can be afforded.

### HARVESTING FOR SEED.

The time of harvesting horse beans for seed depends somewhat upon whether the work is to be done by hand or by machinery. If the crop is to be cut by hand the time can be delayed a little longer than if it is to be cut by machinery. In either case, however, the plants should not be cut until the lower pods are matured and the upper ones fully developed. If the time of harvesting is delayed until the upper pods are ripe a large quantity of seed will be lost by shattering.

While an ordinary mowing machine can be used in cutting horse beans, the drop-rake reaper is a much more satisfactory implement, and with its use but little seed is lost by shattering if due precautions are taken. (Fig. 4.) When a mowing machine is used, it is necessary to rake the crop by hand, using ordinary pitchforks, which entails a great deal of labor. If an ordinary horserake is used, a large quantity

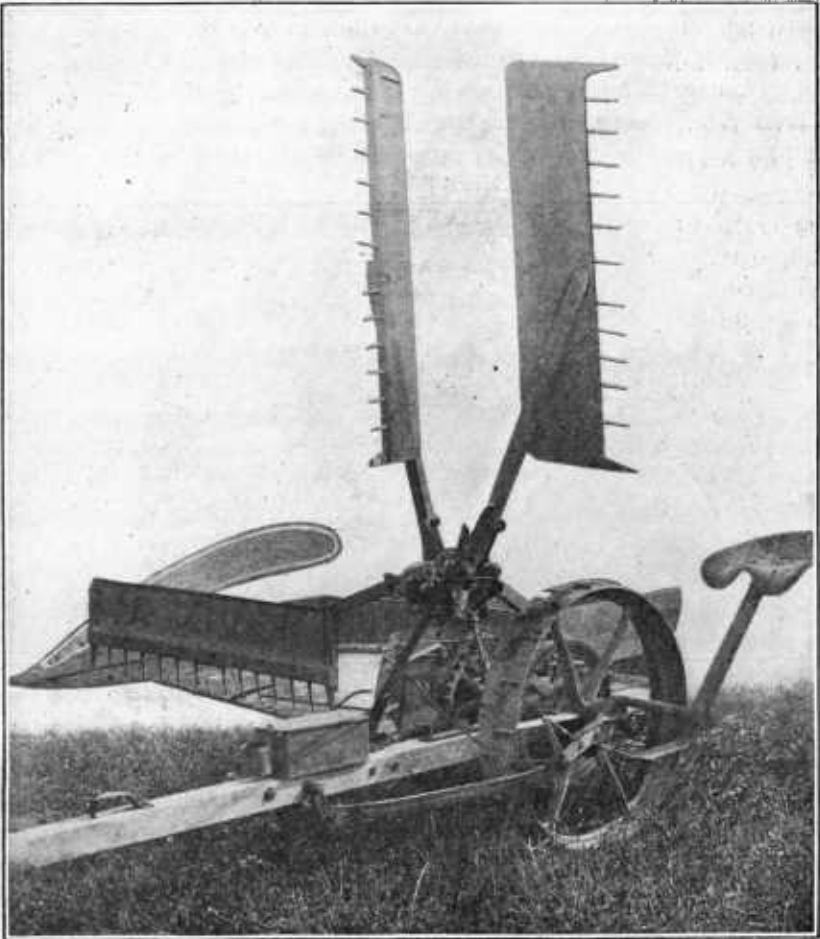


FIG. 4.—Drop-rake reaper used in harvesting horse beans. The plants should not be cut until the lower pods are mature and the upper ones fully developed.

of seed is lost by shattering. While in using a drop-rake reaper under favorable conditions very little seed is lost, it is essential in order to reduce this loss to a minimum that the crop be handled with but little delay.

When possible a cloudy day should be selected for cutting the crop, and if only bright, warm weather prevails during the harvesting

season the cutting should be done at night. If the cutting is done between midnight and morning and the shocking done immediately following daylight, little seed will be lost even during dry weather. The shocking should be done by hand, using an ordinary pitchfork. A fairly good sized shock is desirable, provided the material does not have to be carried too far. (Fig. 5.)

The thrashing of the large-seeded varieties of horse beans is somewhat difficult. However, fairly satisfactory results can be secured by using a common bean thrasher and making special adjustments of the cylinder. The small-seeded varieties can be thrashed without difficulty. In sections where thrashers are not available or when only a small acreage is grown, the crop can be thrashed by the old-time



FIG. 5.—Horse beans cut with a drop-rake reaper and shocked by hand, using pitchforks, Gilroy, Cal.  
A fairly good-sized shock is desirable.

process of rolling. For this purpose a heavy stone roller is most satisfactory, and this method is used to some extent in California. After thrashing with the roller, the seed can be cleaned with ordinary fanning mills or by operating on windy days, when most of the dust and lighter material can be separated by merely throwing the seed into the air and catching it on a large canvas.

But little experimental work has been done to determine definitely the yields of seed of the various varieties of horse beans. In the limited experiments in California and Oregon large yields have been secured. Large yields have also been obtained from commercial plantings. In the most favorable localities and in favorable seasons a yield of 2 tons of seed per acre has been reported. Under average conditions a yield of  $1\frac{1}{2}$  tons per acre perhaps can be expected.

## LONGEVITY OF SEED.

Horse-bean seed retains its vitality for a number of years. Whether varieties differ with regard to the longevity of seed has not been determined. Germination tests of seed 4 years old of a number of varieties grown at Chico, Cal., showed little or no deterioration. From this it would appear that the life of all varieties of horse beans is quite long. While there is no hard seed in any of the varieties so far as known and perfect germination is secured with new seed, there seems to be no disadvantage in using older seed for planting purposes, and in some respects the older seed is decidedly preferable. Seed 1 or more years old will contain no live larvæ or adults of the weevil,<sup>1</sup> and by using such seed the weevil will not be introduced into fields or sections in which it is not already present.

## FUNGOUS DISEASES.

There is but one fungus that severely attacks the horse bean. This is a leaf spot<sup>2</sup> that develops in the spring and does great damage to both leaves and pods. In the warm, humid sections of the eastern and southern United States horse beans are practically destroyed in some seasons by this disease. In the Western States, where more favorable conditions prevail, there is little damage done except to the more susceptible varieties. Experimental work has shown considerable difference in varieties with regard to their resistance to this fungus, and it seems probable that by selecting the more resistant strains the successful growing of this crop can be extended to regions where it is now unprofitable.

## INSECT ENEMIES.

The most important insect enemy of the horse bean is the weevil.<sup>3</sup> In recent years in various sections of California this insect has done serious damage.

The adult insect lives through the winter in the seed, emerging during the period of blossoming of the plants. The female deposits her eggs in the flower of the developing pods, where they hatch and the young larvæ penetrate the young seed. As the seed matures there is little indication of the presence of this insect, but on examination slight depressions and discolorations will be noted on the matured pod and seed. After harvesting, most of the larvæ develop

<sup>1</sup> *Larva rufimana*.

<sup>2</sup> *Ascochyta* sp.

<sup>3</sup> (*Bruchus*) *Larva rufimana* Boheman. Detailed information regarding this weevil is given in Bulletin 96, part 5, of the Bureau of Entomology, United States Department of Agriculture, which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 5 cents. Remedies for this and other bean and pea weevils are given in Farmers' Bulletin 1275. This may be obtained free from the Division of Publications, United States Department of Agriculture.

rapidly, and within two or three months' time many will have reached the adult stage and will have emerged from the seed. However, many of the adults do not emerge until the following spring, when they become the source of infestation of the new crop.

This insect can be killed in the larval stage by heating the seed to 140° F., which will not injure germination, or by fumigating for 48 hours with carbon bisulphid, using 2 or 3 pounds to 1,000 cubic feet of air space. As the entire life period of this insect is but one year, holding seed until the second year will insure its being free from live weevils.

When horse beans are to be used as a vegetable, the damage done by these weevils is very serious. When the crop is to be used for stock feed it is not so objectionable, but even in this case it occasions considerable loss.

Horse beans are often attacked by aphids, or plant lice, which occasionally do serious damage. The aphids feed on the growing plant, sucking or sapping its juices, thus retarding the development of the crop and greatly reducing seed setting. Nicotine sulphate and other remedies advised for the melon aphid<sup>1</sup> are recommended.

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<sup>1</sup> See Farmers' Bulletin 914, "The Control of the Melon Aphis," which may be obtained free from the Division of Publications, United States Department of Agriculture.

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